PATENT SPECIFICATION

729,072

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COMPLETE SPECIFICATION

Improvements relating to Furnaces for Heating Metals, Glass and Ceramic Materials

We, THERMO-INDUSTRIEOFENBAU G.m.b.H., a Body Corporate, organised under the Laws of Germany, of Graf Adolfstrasse 67, Dusseldorf, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

The properties of almost all materials can be influenced by heat treatment and maximum values can be obtained only by a thermal treatment which is carried out in a quite definite manner. This applies especially to objects made of steel, for which a suitable heat treatment may take the place of alloy constituents which are expensive and can be obtained only with difficulty. The higher the demands made on such materials the more accurately and uniformly must the thermal treatment be carried out.

In order that an object may be uniformly heated in a furnace, the energy radiated on to the surface of a heated object, which energy is composed of direct radiation termed " primary radiation " and radiation reflected from the arch or wall of the furnace termed " secondary radiation," must be deflected or combined in such a way that the secondary radiation is caused to act on those parts of the surface at which the primary radiation falls off. The means provided by the invention for this purpose consists in giving the inner surface of the furnace wall a shape which effects the required deflection of the secondary radiation.

The object of the present invention is to provide an improved furnace for the heat-treatment of metals, glass and ceramic materials which is sub-divided by the material, which is traversed through the furnace, into upper and lower heating zones each of which is provided with a heat-reflecting arch, the furnace being so designed that not only is the material heated very uniformly, but being also constructed in such a manner that parts of the furnace can be readily replaced.

According to the invention, the reflecting arches extend transversely of the longitudinal axis of the furnace and are composed of replaceable segments which, when placed together, form the furnace, and the source of heat extends in the direction of the longitudinal axis of the furnace.

Usually, one heating element will be disposed within each reflecting arch, but if broad surfaced plates are to be heated, then a number of heating elements and reflecting arches can be arranged side by side for each surface. As the heating devices, any known heating devices can be used, for example radiant tubes, electric resistances and also the known flame heating, and the object is conveyed along or remains at rest in the dividing plane.

Heating furnaces constructed in accordance with the invention are diagrammatically illustrated, by way of example, in the accompanying drawings, in which :—

Fig. 1 is a cross-section through one form of the furnace ;

Fig. 2 is a longitudinal section through another furnace ;

Fig. 3 is a cross-section through the furnace shown in Fig. 2 ;

Fig. 4 represents a furnace having three upper and three lower sections ;

Fig. 5 is a section through the upper and lower sections of Fig. 4 ;

Fig. 6 is a sectional view showing how the upper section can be tilted ; and

Fig. 7 is a detail view showing the packing between the segments.

Referring to the drawing, the fundamental idea underlying the invention, namely the symmetrical supply of heat, will be explained by reference to Fig. 1.

A steel plate 1 is to be uniformly heated on both sides. This heating is effected by a source of heat 2 and 3 respectively provided

[*Price* 3/-]

for each surface. In the vicinity of each of these sources of heat, the interior of the furnace is in the form of a reflecting arch 4, 5 respectively. The sources of heat 2, 3 effect the primary heating of the object by radiation emitted in the form of a cone which is limited by the arrows 6, 7. The heat radiated becomes progressively less from the centre of the cone outwardly. If the arches situated in the vicinity of the sources of heat 2 and 3 were flat arches the surface of the object would be non-uniformly heated.

The inner shape of the arches, however, is such that additional heat is supplied from the arches curved to those parts of the surface object where the primary radiated heat becomes less. By making the surface of the arch of a suitable curvature the temperature curve on both surfaces of the material can be made the same. The additional reflected radiation is indicated in the drawing by the arrows 8, 9.

If a flat object of not too great a width is to be heated, and the width is such that it can be conveyed through the furnace, in the case illustrated in Fig. 1 at right angles to the plane of the paper it is sufficient to use only two sources of heat 2, 3 and correspondingly to provide only two reflecting arches. When heating an object having a broad surface, whether it is at rest or is fed forwards, several sources of heat are arranged one beside another opposite each of the surfaces and a transverse arch is provided in the vicinity of each source of heat. In this way one arrives at the furnace illustrated in Fig. 3 which possesses, in addition to the arches 4, 5 the further reflecting arches 14, 15.

The furnace shown in Fig. 2 is a tunnel furnace through which the material is passed and it has the cross-section illustrated in Fig. 3. The reflecting arches consist of independent sections which are combined both in the upper part and also in the lower part of the furnace. The sections are interchangeable and they can be removed separately or raised or tilted aside. The object to be heated is moved along the plane of separation of the upper and lower arches and, in the example illustrated, the object consists of a number of billets placed side by side and forming a long table.

In order to obtain a pre-determined thermal effect, the furnace is divided into two zones which are separated one from the other by a cooling zone 19 provided with cooling devices of a known kind and with an inset arch.

The furnace shown in Figs. 4-7 consist of three upper sections 20 and three lower sections 21. The joints between the sections are made gas-tight by means of packing rings 24 which are held in place by metal bands 25. The upper sections can be tilted as shown in Fig. 6.

In Figs. 4-7 the source of heat, which is not illustrated, is similar to that in Figs. 1-3 and the furnace is divided by the material to be heated into upper and lower reflecting zones. As will be seen from Figs. 5 and 6, the curves of the upper and lower reflecting arches are not circular arcs and the shape is such that the material passing through the furnace is heated substantially uniformly by radiation from the walls of the arches.

When the furnace according to the invention is constructed as a push furnace, the rails on which the material is moved may be made of ceramic material and they are un-cooled.

The furnace of the invention has only two doors, namely an inlet door and an outlet door. In general the furnace can be operated entirely automatically and the temperature of any or all the heating devices, the furnace atmosphere and the pressure can be regulated.

What we claim is :—

1. A furnace for the heat-treatment of metals, glass and ceramic materials which is sub-divided by the material, which is traversed through the furnace, into upper and lower heated zones each of which is provided with a heat reflecting arch, characterised in that the reflecting arches extend transversely of the longitudinal axis of the furnace and are composed of replaceable segments which, when placed together, form the furnace, and the source of heat extends in the direction of the longitudinal axis of the furnace.

2. A furnace in accordance with Claim 1, having at least one unheated segment, the arch of which is situated close to the material which passes through the furnace.

3. A furnace in accordance with Claim 1 or Claim 2, in which the material is moved through the furnace on rails which are uncooled and are made preferably of refractory ceramic material.

4. A furnace for heat-treating materials substantially as described with reference to Fig. 1, Fig. 2, Fig. 3 or Fig. 4 of the accompaning drawings.

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729,072 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

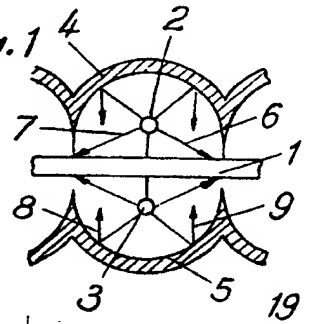

Fig. 2

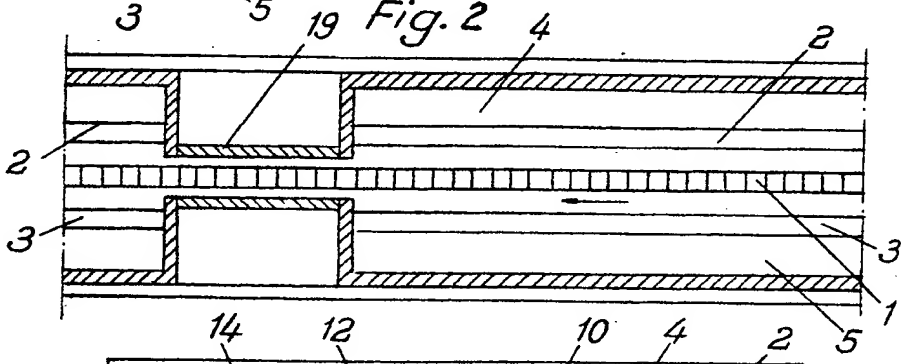

Fig. 3

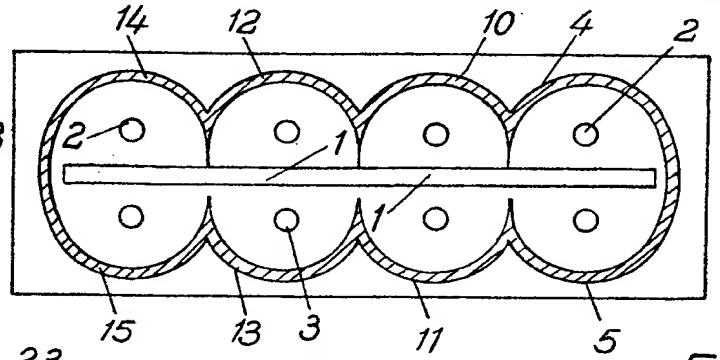

Fig. 4

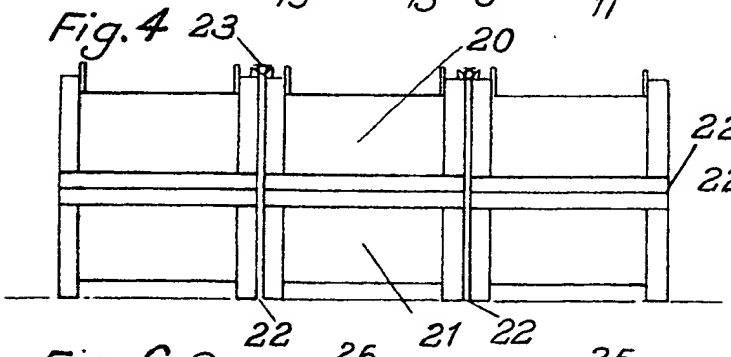

Fig. 5

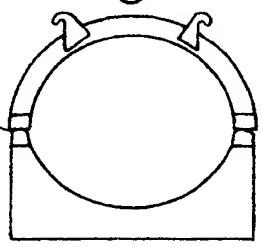

Fig. 6

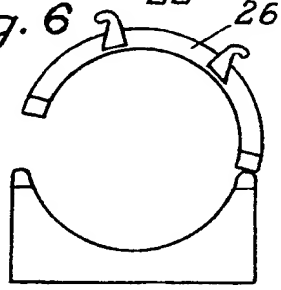

Fig. 7